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PACIFIC NORTHWEST MINERALS IN WARTIME*

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War conditions have directed the attention of government and industry to the expansion of mineral production thruout the United States. The Pacific Northwest, that is, Oregon, Washington, Idaho, the mountain counties of Montana, and southern British Columbia, has shared in that development. For sixty years this region has been a large producer of the base minerals, copper, lead and zinc. It is less known for the occurrence of many other minerals important for the preparedness program. Recent developments have directed attention to the light metals, the steel alloys and quicksilver.

The two areas of greatest commercial importance are the northern Cascade Mountains and the northern Rockies, where crustal disturbances and intrusions of igneous rock favored the formation and deposition of useful minerals. The southern and central Cascades represent the higher volcanic parts of the great lava flows of the Columbia Basin and they contain few valuable minerals, but intrusive granite and metamorphic rocks predominate in northern Washington. and here copper occurs in quantity. Where the Rockies consist of sedimentary and surface volcanic rocks metal mines are rare, but where these rocks have been strongly metamorphosed by heat and other causes, or where huge igneous intrusions (batholiths) of granitic rock have occurred, many ore deposits have been formed. These are located mainly in central and northern Idaho, western Montana, and northeastern Washington. The Klamath Mountains in southwestern Oregon and the Blue Mountains in northeastern Oregon are other areas of some importance. The Owyhee Mountains and Basin Ranges in southern Idaho and the

* The preparation of this paper was assisted by a grant-in-aid from the Northwest Regional Council, Portland, Oregon. This agency plans to publish a more complete treatise on the same subject.

Olympic Mountains in Washington are of some minor significance.

The geography of the northwestern states offers several advantages for the mining industry. Both Cascades and Rockies are of such altitude that orographic precipitation is heavy, snows are deep, and runoff provides steady flow of large streams which may be converted into hydroelectric power on a vast scale. Hence the Pacific Northwest has about forty per cent of the potential water power of the United States; of this amount, several million horsepower have been developed by hydroelectric plants. Sites in mountain canyons and the valleys deeply eroded in the lava plateau offer excellent locations for reservoirs and dams, of which those on the Columbia River at Bonneville and Grand Coulee are best known.

In spite of advantages of water supply and power, the Pacific Northwest mining industry has been handicapped by two factors: first, lack of industrial development and a nearby consuming market; and second, freight costs and time involved in shipping concentrates and the metals from smelters to plants in the East for further treatment and manufacture into finished articles. Under present war-time conditions however, the situation is changing. West-coast cities have grown considerably with the influx of tens of thousands of defense and war plant workers, partly remedying a lack of local markets. Furthermore, exigencies of war have placed such a burden upon our transportation system that long freight hauls must be eliminated as far as possible, and complete processing of raw materials must be accomplished close to the mines. Development of specialty manufactures in the Northwest, especially the large aircraft plants in Seattle and the shipyards in the Portland and Puget Sound districts, has created a large demand for light metals in finished form. Some stimulation of manufacturing and processing of iron and steel has also taken place.

LIGHT METALS

Aluminum. Among the light non-ferrous metals, aluminum is of increasing importance in the Northwest. Present processes of manufacture require very large amounts of hydroelectric power, and this, with the aircraft industry's demands, has tended to bring aluminum manufacture to this part of the country. Bauxite from British or Dutch Guiana or Arkansas is reduced to alumina at plants in East St. Louis, Mobile, or Lister, Alabama, and then

shipped to the Northwest where sources of electric power are available for final reduction to metallic aluminum. The metal then has been shipped to eastern cities for rolling into sheets, and returned to Seattle for aircraft construction. This confused and uneconomical system involved excessive shipment costs. The situation will change soon as two aluminum rolling plants are ready to begin operations in the Northwest. In 1942, there were five aluminum smelting plants operating in the northwestern states. The completion of rolling mills to process the metal will supply most of the demands of west-coast markets. The estimated total production will soon reach six hundred million pounds of aluminum annually, which exceeds the entire production of aluminum in the United States in 1940 by fifty per cent. It is possible that supplies of leucite and alunite, available in quantity in Wyoming, Utah and Washington, may partly replace bauxite as a source of aluminum in the future, altho production costs probably would be higher than those of aluminum obtained from bauxite. Certain clays from northern Idaho and Washington are being tested also as possible sources of aluminum.

Magnesium. Magnesium offers a satisfactory substitute for aluminum in many types of aircraft. Until 1940, American production of this light-weight metal was confined to extraction from brines in Michigan and Texas. In the Northwest, however, a new plant at Spokane, now nearly completed, will extract magnesium from an ore, dolomite. In addition to dolomite, magnesite is present in northeastern Washington near Chewelah, where the world's largest known deposits are available. Probably this source will be utilized in coming years as magnesite contains nearly twice as much magnesium as dolomite. The use of the lower grade material is explained by the fact that plants elsewhere, having no magnesite at hand, have succeeded in making magnesium from dolomite, and it seemed advisable under emergency conditions to use known processes.

BASE METALS

Copper. At present the Pacific Northwest produces about one-sixth of the nation's copper. The leading center is Butte, Montana, whose production is second only to that of the Bingham Canyon in Utah, among the copper districts of the United States. In the Coeur d'Alene mining district of the Idaho panhandle some copper is

obtained as a by-product from lead-silver-zinc ores. Occurrences of copper ores are numerous at other points in the Northwest, but production is insignificant except in Washington.

The most recent development of copper mining is at Holden, near the upper end of Lake Chelan, Washington. This is the direct result of efficient and orderly development by an experienced mining company. Holden first attained large-scale production in 1938, altho the presence of copper ores at that point has been known for over fifty years. The mine is situated in the mountains about two thousand feet above Lake Chelan, fourteen miles up Railroad Creek from the lake shore. Many problems faced the developers. A large mill to concentrate the ore, a model town for the miners, and a highway from the lake to the townsite were all constructed. Provision was made for storing tailings to prevent fouling the stream and lake. Barges were built to haul the concentrates down Lake Chelan to the railroad connection. The mine is so remote that costs of transportation equal all other expenses of the project. The ore contains both gold and copper of nearly equal values. In 1940, this single enterprise produced 92,888 tons of copper and 51,444 ounces of gold, together worth about four million dollars. By good management, neither the surrounding forest nor the fish in the streams have been injured by the mining development, something which is unusual in the vicinity of most western mines.

Many copper smelters serve the Northwest. They are located at Anaconda and Great Falls, Montana; Tacoma, Washington; Trail, British Columbia, and near Salt Lake City, Utah. By-products from the smelting operations include sulphuric acid, bismuth, arsenic, lead, zinc, cadmium, silver, and other minerals both metallic and non-metallic. Modern treatment methods make it possible to recover copper from ores containing only one or two per cent of copper; formerly such low-grade ores were considered worthless because of the high costs of extraction.

Lead. Lead, with which this nation has been well supplied, is needed in war operations in such quantity that we no longer have a surplus. New sources of the metal are being sought. Missouri has long been the center of American production. Idaho is the second ranking state primarily because of the ores of the Coeur d'Alene mining district, from which comes nearly one-fifth of the nation's lead. The south-central section of Idaho also produces considerable amounts. Lead is produced in the Northwest in connection with the

mining of copper at Butte and from other mines in Montana. Washington and Oregon are of little importance for lead. Smelters are situated at Kellogg, Idaho; Trail, British Columbia; East Helena, Montana, and near Salt Lake City, Utah.

Zinc. Zinc is often associated with the production of lead, and is important also in the Northwest. Idaho is the third producing state and again, the Coeur d'Alene district is the leading section, while Butte is fifth in rank among zinc mining districts of the United States. In Washington, the town of Metaline in the northeastern part of the state is a zinc-mining center. Together, the four Northwest states produced fifteen per cent of our zinc in 1940. Probably the world's largest zinc mine is situated at Kimberley in southeastern British Columbia. Plants for the extraction of zinc from complex ores by a solution and electrolytic process are located at Trail, B.C., Kellogg, Idaho, and Great Falls, Montana.

Alloy Steel Metals

Several metals required for making alloy steel are mined in the Pacific Northwest. Chief among these are manganese, chromium and tungsten.

Manganese. Manganese is used to remove residues of oxygen and sulphur from the molten iron that is being changed to steel. Manganese also toughens steel and is of great importance in the manufacture of most alloy steels. Usually from twelve to fifteen pounds of manganese to the ton of steel is required. Formerly our manganese came mainly from Russia, India, and Brazil. Altho the state of Montana produced manganese during the last war, the only American mines which have operated continuously since then are situated near Philipsburg. These have been supplying about eight per cent of our needs. The principal ore reserves, however, are located at Butte. Production there is now large and will continue thruout the war, at least. The Butte ores are concentrated before shipment east to the steel mills. Oregon has some supplies of manganese in the Klamath district and in the Blue Mountains. Washington has an extensive belt of manganese ore in the Olympic Mountains in the northwestern part of the state, and mining was active near Lake Crescent in 1942. As an aid to the industry, the federal government is planning to build and operate two manganese processing plants in Utah and Montana to provide a market for the ore from small Northwest producers.

Chromium. A second alloy metal, chromium, is increasingly important in the Northwest. Under normal conditions, the ore, chromite, is brought to this country from South Africa, Turkey, the Philippines, and Cuba, but now transportation from these countries is cut off or impaired, and the government has accelerated the search for domestic supplies. Under similar conditions in 1918, more than one hundred chromite properties were developed in Oregon, and about 18,000 tons were shipped. Grant County in central Oregon and Josephine County in the southwest have the most mines and production altho known deposits are small. Careful management and government financial assistance are required to stimulate production. A newly discovered and prospective large source of chromite is in beach sands along the Oregon coast, from which there will be some chromium extracted in 1943 by a plant now under construction.

In Montana, a major development of chromite is under way in Stillwater and Sweet Grass counties, where three mills are under construction, financed by the federal government. The reserves of chromite here are estimated at two million tons, containing at least fifteen per cent of chromium. While producing costs may be too high for adequate profit in ordinary times, during the present emergency production of chromium is worth while because the great needs of the steel industry must be supplied regardless of expense.

Tungsten. A third steel alloy, tungsten, ordinarily is imported from China and some of the South American nations. There is some domestic production in California, Colorado, and Nevada. In 1942, however, development work on antimony mines at Stibnite, in west-central Idaho, disclosed rich bodies of tungsten ore, and before the year closed this new district became the leading producer in the United States. There are some smaller tungsten mines elsewhere, especially in Lemhi County, Idaho, and in Stevens County, Washington. Molybdenum can be used as a substitute for tungsten, and since the United States produces more than ninety per cent of the world's molybdenum, this is frequently done. Most American molybdenum comes from Colorado, but there has been a little produced in the Northwest, chiefly from northeastern Washington where there is a possibility of expanding the present small output.

IRON AND STEEL

It is apparent from the preceding description of mining developments in the Northwest that special-purpose minerals are

emphasized in this part of the country. The region is not entirely lacking in basic materials for iron and steel manufacture, however. Coal resources of Washington are estimated at more than sixty-three billion tons, and Oregon has reserves of several hundred million more. Most of this coal is bituminous or sub-bituminous, and some is suitable for coking. Most of the veins lie near the Cascades in Washington, and they have been worked for many years altho they do not entirely meet the state's needs. Vancouver Island also has good coking coal. Increasing use of electricity in the manufacture of steel may make northwestern hydroelectric power resources of greater importance than coal supplies in this industry.

In spite of apparent raw material deficiencies, the Northwest has carried on steel production on a small scale for some years. Two steel mills are operating at Seattle, and one is being built near Portland. The larger mills use the open-hearth process and rely upon scrap iron instead of iron ore for their raw material. One of the plants is of the electric furnace type. Expanding manufacture of war goods, especially ships, has stimulated interest in northwestern steel manufacture. Investigation of iron ore deposits has disclosed some that seem promising. Limonite is available near Portland and magnetite ores are found in parts of Oregon and Washington, where three small mines are operating. There is a project under way to build an electric furnace in north-central Washington to manufacture ferro-silicon to be used as a deoxidizing agent in the open-hearth steel process. Iron ore can be made into sponge iron that might be substituted for scrap iron in the steel furnaces and a plant for this purpose is under consideration.

MINOR METALS

Mercury. Another strategic material of great war-time importance is mercury or quicksilver. We usually import about one-third of our annual requirements, but foreign sources in Italy and Spain are no longer available. California leads in output of mercury in the United States, with Oregon next in rank. Cinnabar is mined chiefly in southwestern, southeastern and central Oregon, where recent lavas such as basalt, andesite and rhyolite are found, and with which mercury deposits are commonly associated. In 1942, there were twenty-three known producers of mercury in Oregon. Idaho had an important mine near Weiser, but this exhausted its ore and ceased operations at the end of 1942. There is some production of mercury in western Washington and southern British Columbia.

Antimony. One special-use metal, antimony, is of great importance in hardening lead for bullets and for numerous other purposes. Heretofore this metal has been imported, and until the war interfered, it came largely from China, where high-grade ore and low-cost labor were available. In small amounts, antimony has been obtained as a by-product of smelting operations, principally at Trail, B.C. Recently several million tons of the ore of antimony, stibnite, were discovered in the Yellow Pine district of Valley County, Idaho. Since the beginning of 1942, development of this deposit has been pushed under war-time stimulus until its product will go far toward replacing antimony from foreign sources. A new mining center, the town of Stibnite, Idaho, and a new highway have been built to aid in developing the deposits.*

Silver. Altho the United States possesses adequate supplies of silver, it promises to become a strategic material if its use as a substitute for copper in the electrical industry continues. Huge bus bars of silver have been installed in the electrical furnaces that process light metals in the Northwest. The largest silver mine in the United States is the Sunshine, situated in the Coeur d'Alene district of northern Idaho. Idaho is the largest producing state, followed by Montana and Utah. Together, the states of the Pacific Northwest produced forty-three per cent of this nation's silver (70 million ounces) in 1940.

Other Minerals. Four minor metals are produced in the Northwest, largely as by-products of other mining operations. These are bismuth, arsenic, cadmium, and platinum. Bismuth is produced at smelters in Anaconda, Trail, and Kellogg, and from a mine near Dillon, Montana. The material is used in the manufacture of tools, airplanes, and automobiles. Arsenic, used to harden lead, copper and zinc, is obtained by similar processes. Cadmium, with properties and uses similar to those of antimony, is a by-product of smelting other ores, and is recovered at Trail, Kellogg, Great Falls, and at Midvale, Utah. Platinum, of critical importance in the manufacture of specialty instruments for war use, has been obtained in small quantities from beach placers of black sand on the coast of southwestern Oregon. Other supplies come from placer-mining of gold and as a by-product from refining gold and copper ores.

* The whole enterprise is so recent that "The Pacific Northwest," edited by Freeman and Martin during the winter of 1941-1942, makes no mention of antimony production at Stibnite.

Metals of Potential Importance

Heretofore this paper has been concerned only with actual production of minerals in the Northwest. Others which may be produced in the near future if national requirements justify the expense of mine and mill installations include beryllium, titanium, nickel, cobalt and vanadium. The vanadium occurs in the phosphate of southeastern Idaho, and some of this essential alloy-steel metal is recovered at Anaconda, Montana, as a by-product during the manufacture of super-phosphate fertilizer. Small occurrences of tin ores are known, but production is unlikely. Many other commodities of mineral origin are now in production, especially certain abrasives and non-metallic minerals.

Non-Metallics

Magnesite. At Chewelah in northeastern Washington is the largest known deposit of magnesite in the world. This material is an essential for fire brick and the lining of furnaces and crucibles used in steel manufacture. Usually much magnesite is imported from Europe but with the supply shut off in World War I the Chewelah deposits were developed to supply the needs of the country. Production on a reduced scale continued after the war and now has been greatly expanded in order to fill the requirements of the present huge output of steel during the second World War.

Strontium, another non-metal, is being produced in northwestern Washington, east of Puget Sound. It is used for flares, tracer bullets, red fusees, and the like.

Conclusion

The Pacific Northwest has been noted for the quantities of foodstuffs and raw materials such as lumber and metals which it has shipped to other parts of the nation. As a result of demands during World War I, the magnesite industry at Chewelah became permanent. In this war, it is possible that the Northwest will gain many new mineral industries that will be of permanent value to its economy. With these, it is also possible that the Northwest will acquire new manufacturing plants and change from the simple extractive industries to complete processing of its own raw materials, producing metal wares to meet the demand of its own markets and those of western America with which it has special transportation connections. Exports of metal wares to the Orient and other world markets are also among the possibilities.

MOSQUITO FIGHTERS OF GUAYARAMERIN AID RUBBER TAPPERS

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Deep in the interior of the vast Amazon Valley, some 2,000 miles up the great river system, the little town of Guayaramerin, Bolivia, has become the site of an inter-American project to save the lives of rubber tappers.

Guayaramerin is situated across the Rio Mamore from Guajara Mirim, Brazil, terminus of the 228-mile Madeira-Mamore Railway built at the height of the Amazon rubber boom before the First World War. Now the tiny river port, providing access to the great Amazon River system, is important to plans for increasing rubber collection for the United States market. Rubber collected in the near-by forests passes thru the port on its way to big shipping centers down-river.

Once Guayaramerin boasted a population of more than 1,000. Today the population is less than 500. But Guayaramerin again looks forward to bustling days of rubber traffic and an increase in population. That partly explains why the little town in the heart of the rubber-bearing country has been selected as project number one in the Bolivian-United States health and sanitation program.

The Bolivian program is part of the broader inter-American health and sanitation work recommended at the Rio de Janeiro Conference of American Foreign Ministers and now being carried out by the Office of Inter-American Affairs in Washington in conjunction with health authorities in the other Americas.

Last August, the first of the public health specialists assigned by the Office of Inter-American Affairs to work with Bolivian authorities visited Guayaramerin. The head of the group was Dr. E. H. Payne, chief of the field party in Bolivia. They went by air, for the quickest transportation to this remote town, in the lowlands of northeast Bolivia, is by airplane from La Paz, the capital of Bolivia, high in the Andes Mountains. Dr. Payne made a quick survey of the situation, decided the first need was malaria control.

In this densely forested area, with its millions of rubber-bearing trees, malaria is the deadly scourge of man. Medical authorities say this is one of the most malaria-infested areas of the tropics. In the hot humid forests and swamps breeds the anopheles mosquito, carrier of malaria.

Southeast of the town, the local medical authorities pointed out three large swamps. Here was a sanitation problem to be attacked in the effort to free the rubber town from malaria. It was work which had to be done in preparation for the expected coming of hundreds of additional rubber workers.

The region is counted upon to provide a substantial part of the additional rubber sought under the inter-American program for developing natural rubber resources of the hemisphere. Both Brazil and Bolivia have contracted to sell to the United States their exportable rubber surplus and have agreed to stimulate production. One of the contributions of the United States to this joint effort is health and sanitation assistance.

The river town of Guayaramerin is at the Brazilian-Bolivian border. That increases its strategic significance as a center for rubber development.

So the campaign against mosquitoes and their swampy habitats around Guayaramerin became a part, altho a tiny part, of United Nations strategy of supply. Amazon rubber is counted upon to replace some of the rubber lost in Malaya and the Netherlands Indies.

Tropical experience has shown sanitation work must be closely tied in with industrial development in such places as the Amazon rubber country. Thus the Guayaramerin fight against the mosquito got under way as a skirmish in the main war on malaria in the Western Hemisphere rubber areas.

Soon field reports began to flow into the Office of Inter-American Affairs in Washington. How this campaign moved in its early stages is typified in reports from one of the field workers:

"Spent four days dipping ponds for larvae, catching adult mosquitoes, attempting to identify both adults and larvae.

"It appears that most of the anopheline breeding will be actually in the town when the rainy season starts because of the number of man-made holes resulting from excavation for building purposes. These holes must be filled."

Dr. Payne and his aides drew up a plan of mosquito control and went to work. Ingenuity was required at every turn. Guayaramerin is far from the conveniences of urban centers. Transportation in the rubber country is mostly by small boats, by mule or by foot. Dr. Payne saw need for a hospital and dispensary. But first he had to look for a saw mill to cut the lumber for construction. He had to arrange for other essential supplies from distant sources, including

medicines from the United States. Here the airline provided quick means for bringing in urgent medical supplies.

Also requiring immediate attention was the training of a local patrol of mosquito fighters. These men are called "guardas." To these mosquito fighters fall the tasks of scouting mosquitoes and their breeding places, spraying breeding places with oil, dusting larvae with Paris green to kill the malaria carriers. The mosquito hunters are the advance guard of protection for the rubber collectors.

More formidable was the problem of the near-by swamps. By last reports from remote Guayaramerin, this problem was still being studied by the field party. Also under consideration was the matter of improving the water supply and sanitation facilities. Yet the war on mosquitoes in the Amazon Valley had reached the distant outpost of Guayaramerin.

The little town is shut off, except by air, from ready access to the Pacific seaboard of the South American continent by the towering Andes ranges. That makes communication with the outside world difficult. Still, with the skirmish against mosquitoes under way, this project has excited the interest of those who are following closely the largest inter-American program ever undertaken to support tropical industrial development with modern health and sanitation measures.

As in Brazil, Peru and other countries cooperating in the program, the work in Bolivia will take on varied aspects as projects evolve. In the planning of these, Bolivian health authorities are working hand in hand with United States technicians.

Rubber development alone will require much work outside the Guayaramerin area. There are large tracts of abandoned rubber lands in northeast Bolivia. Besides malaria, the rubber country has to fight other tropical diseases and health risks of the hot. humid forests. Cited by Bolivian authorities are yellow fever and amoebic dysentery. There are, furthermore, wounds caused by snake and scorpion bites, the attacks of animals.

Travellers in the region have been enjoined by experienced medical men to avoid dangerous sting rays, electrical eels, and, unique among forest perils, attacks of piranhas or cannibal fish. Travellers likewise have been warned to go into the region heavily booted and to watch for blind worms, ants, and wasps, to avoid touching hairy larvae and spiney plants. These are among the risks

of the jungle. They are risks taken by the rubber tappers ranging the forest trails.

It is a peril which matches in some ways the risks to life taken by soldiers in the front lines of the overseas battle fronts.

Travel in the upper reaches of the Amazon system is hazardous, especially when it gets off the main waterways into forested mountainous regions. Here progress is impeded by falls and rapids. Movement over the far-inland water trails is accomplished by small boats or rafts made of light-weight balsa wood. Poor communication contributes to the difficulty of moving in supplies for the health and sanitation work. The region is sparsely populated. Labor must be brought in from distant sources.

Lower down the Amazon River system, away from the Andes slopes, the Amazon country becomes an immense stretch of forested plains. This region floods easily in the heavy rainfall, especially between December and April. In the rainy season, work moves slowly or not at all. Launches and small boats on the rivers become the only practical transportation, aside from airplanes.

Fortunately, the development work in the upper Amazon can call upon the airplane to overcome flood and mountains. But the airplane, in the work now going forward, must be supplemented by older forms of transportation, everything from balsa wood rafts and motor-driven launches to the old reliable mule and foot power. Only by use of all these can the jungle be conquered and mosquito fighters carry on their campaigns as far away from well-travelled roads as in the Guayaramerin area.

The little river port, in the heart of the deep Amazon rubber-bearing country, thus symbolizes the global struggle. Rubber from Guayaramerin eventually may go into manufacture of many tires for bombers and army trucks and so contribute toward victory. In this all-embracing struggle, mosquito fighting 2,000 miles up the Amazon, too, may contribute its mite to the victory.

GEOGRAPHY IN THE HIGH SCHOOLS OF ARKANSAS

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In a democracy where governmental policies are molded largely by public opinion, the lack of a considerable body of informed citizens may lead to serious danger. In a world in which a global war is being fought, citizens need a comprehensive knowledge of the principles and places involved. Today, more than ever before, we need a workable knowledge and understanding of the entire world of nations. We need to know their major problems and their facilities for solving these problems. To understand the background of this war we need to know the history, the present economy, and the geography of the countries which are at war. To understand the objectives of armies and the strategy of their movements, we need to know world geography. Those who sit at the peace table at the end of the war must have a comprehensive knowledge of the people and the lands concerned, and the great mass of world citizens behind the diplomats must know the basic needs of this modern world and its component nations.

Today, a knowledge of world geography is essential to daily living. Even intelligent reading of newspapers requires the ability to use maps and atlases. We are constantly reading and hearing of heretofore unknown places, and are adding to our store of information. Are future generations being prepared for such a manner of living? Are the schools giving the children of the nation the fundamentals required for intelligent world citizenship? The need for a greater knowledge of the world in which we live is not being fully met.

Many students leave school with no knowledge of the world in which they live. Far too many of them have no conception of places, distances, or economic relations between the countries of today's world. "Apart from rather backward nations, we are more illiterate geographically than any civilized nation I know. The reason is that we have never really taught geography."[1] The weakest link in geographic training is in the high school. Most elementary schools teach geography in one-half or more of the grades. In the majority

[1] Dr. John W. Studebaker, U. S. Commissioner of Education, in an address delivered at a National Conference of College and University Presidents, Baltimore, March 3-4, 1942.

of the colleges and universities the subject is fairly well represented. Very few high schools, however, teach more than one year of geography, a great many provide only one-half year, and far too many of them offer no opportunity whatever for study in the field.

With the knowledge of these facts in mind the writer undertook a study of the geography taught in the high schools of Arkansas.[2] From the reports (for 1940-1941) of individual superintendents to the State Department of Education, sufficient information was obtained to give an adequate picture of the offerings and enrollment where geography is taught, and of the training and experience of the teachers of geography. The schools studied include both four-year senior high schools and some junior high schools. In the latter type of school only the work above the eighth grade level was considered.

COURSES IN GEOGRAPHY

Number of Courses. Of the total of 543 high schools in Arkansas, only 237 teach geography. This is 43.6 per cent of the total number of schools. The total number of courses in geography, by size of schools, is far greater in those with from 50 to 100 students than in any other (Figure 1). There are twice as many courses in schools of this size as in any other. More than three-fourths of all geography courses are taught in schools of less than 150 students. It must be noted, however, that almost three-fourths of the high schools in Arkansas are below 150 in total enrollment.

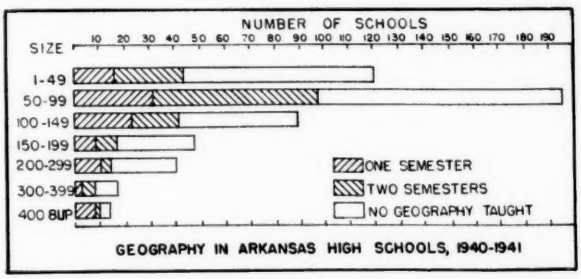

Fig. 1. Number and length of courses in geography, by size of schools.

There is no great difference in the proportional offerings by size of schools, with the exception of those of more than 400 students. More than 70 per cent of these offer courses in geography. The number involved, however, is not large (only 14), and the

[2] This particular State has no significance other than that it was the residence of the writer at the time the study was begun. It may be considered, however, as representative of a large group of southern States.

total number of students studying geography is relatively small in comparison with the enrollment of the schools. The high percentage of these schools offering geography may be attributed to the better facilities and larger faculties which permits a greater variety of offerings.

The second highest percentage of schools which teach geography are those of from 50 to 100 students. More than half of these teach geography. The fewest number of courses per number of schools in different size groups is found in the schools of less than 50 students. There are 120 such schools and only 44 of them teach geography, probably because of extremely limited facilities, including teaching personnel. Where geography is taught in one of these smaller schools, a large part of the student body is enrolled.

Only formal courses in geography which are so designated in the list of subjects for which each school is accredited are considered here. There may be some geographic instruction in courses listed under another title; there certainly is in the training in conservation of natural resources which is now required for graduation from any high school in the State.[3] In some schools this training in conservation is given as a separate course, but in many it is integrated with other courses. Since it is present in all high schools which meet the legal requirements of the State, it need not be further considered here.

Distribution. The high schools of Arkansas are more numerous in the regions of relatively low relief, as are also the schools in which geography is taught (Figure 2). In the Ouachita Mountain region which extends from the middle of the western boundary to the center of the State, and in portions of the Ozark Plateaus across the Arkansas Valley to the north, there is a less frequent occurrence of schools. In an area adjacent to the Mississippi River in the southeastern and eastern part of the State there are fewer schools. This is chiefly because of a lower proportion of white population. (The colored schools are omitted from this study.) Fairly dense concentrations, both of schools and of those which teach geography, occur in the better parts of the State. These include the Arkansas River valley, the northwestern corner of the State, the petroleum field of south-central Arkansas, and much of the remainder of the Coastal Plain region. A noticeable line of

[3] Collier, J. E., "Conservation Education in Arkansas," JOURNAL OF GEOGRAPHY, Vol. 41, March, 1942, pp. 101-111.

numerous schools extends along the inner edge of the Coastal Plain diagonally across the State from southwest to northeast. All of these areas of concentration of schools are the more densely populated areas and the more prosperous ones. It can hardly be said that proportionally more schools in one part of Arkansas teach

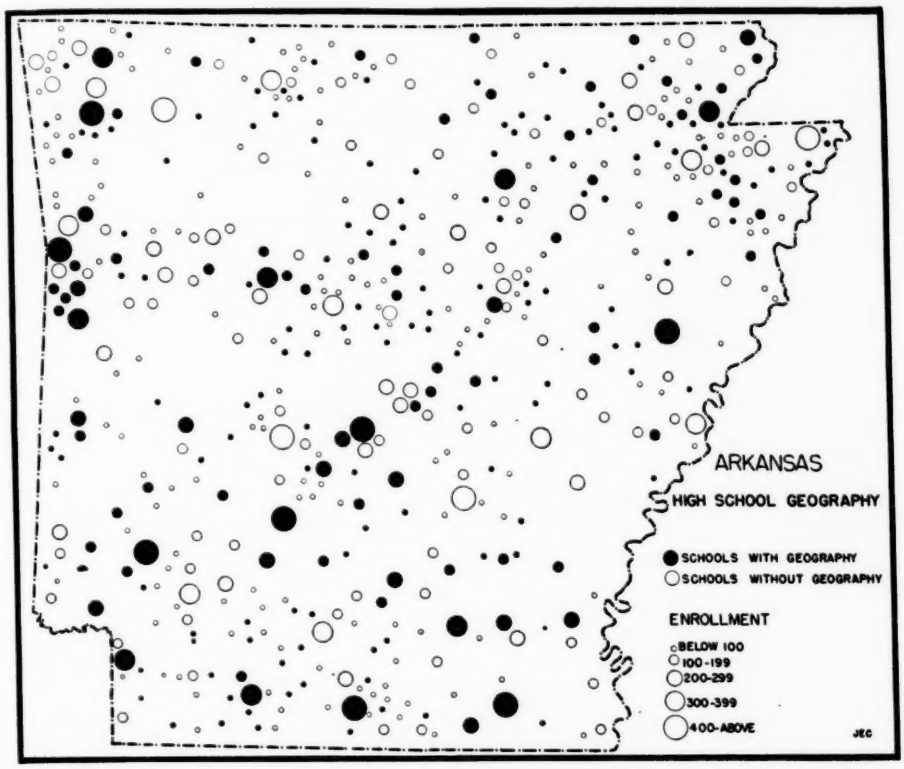

Fig. 2. Location and distribution in high schools in Arkansas, and of those which teach geography.

geography than those of any other part. Most of the larger schools have courses, but a high proportion of the small rural schools which are widely scattered over the State do also.

Length of Courses. A little more than one-half (56.5 per cent) of the courses in geography are a full year in length (Figure 1). These carry one unit of credit and fulfill that portion of the requirements for graduation. In a few instances one full year course and another of one-semester length are taught, giving a year and one-half in all. In many schools one-semester courses are taught, with

another half-unit course, such as economics, completing the year. Several of the larger schools have an enrollment in geography classes large enough to require more than one section. Ten schools, all of which have an enrollment of more than 400, have from two to six sections each. There is a total of 27 sections in these ten schools, and they range from 20 to 48 students per section.

Enrollment. Less than half of the students in the high schools of Arkansas have an opportunity to study geography. Only 42.4 per cent of the students are enrolled in schools which teach geography. The number actually enrolled in these classes is only 8 per cent of the total number of high school students, altho this is 18 per cent of the students in the schools which teach geography.

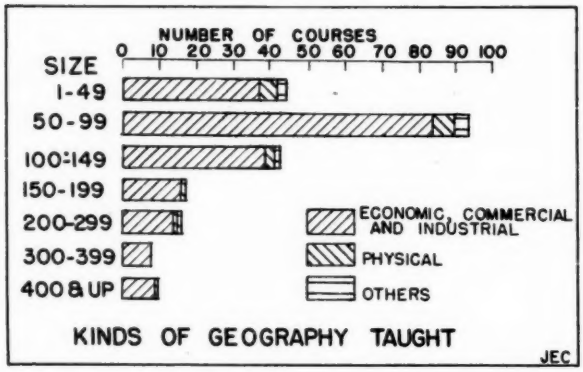

Fig. 3. Nature of the courses in geography.

Considering only those schools in which geography is taught, it is found that the largest enrollment in geography in proportion to the total enrollment is in the smaller schools of less than 100 students. More than one-third of all the students in schools under 50 study geography. This drops to one-fourth in schools of from 50 to 100 students, and to one-sixth in the schools of the 200 and 300 size groups. Only one student in ten studies geography in the schools with an enrollment of more than 400 students.

In a few instances, in the smallest schools, the geography class is the same size as the school. That is, every student takes geography. In a great many small schools one-half or more of the student body may be in the geography class. In all such cases geography is practically a required subject, since the inadequate facilities permit only a minimum of offerings and the total possible credits is only 16 units. Quite frequently the geography class may include all of the third and fourth year students. With the exception of these cases geography is almost entirely an elective subject.

Kinds of Geography Taught. Nine-tenths of the geography courses in Arkansas high schools are economic in content (Figure 3). More than half are listed as Commercial and Industrial, 10 per cent as Commercial, nearly 12 per cent as Industrial, and 13 per cent as Economic. Only 7 per cent are Physical Geography. This major emphasis on Economic, Commercial and Industrial geography may be attributed to the curricula recommended by the State Department of Education and to the adoptions of the State Textbook Commission. The basically adopted text in high school geography is economic in treatment, as are also most of the alternate selections.

Grade Placement. Most of the high schools of Arkansas which teach geography do so during the last two years of the student's work (Figure 4). Nearly 70 per cent of all courses are credited to one or the other of these years, or to both. The grade placement of 10 per cent of the courses was unaccounted for in the available reports. Approximately 15 per cent of the courses are given in the ninth and tenth grades, and 5 per cent more in a combination of the tenth and eleventh grades. Ninety-one (38 per cent) of the 237 courses are made up of a combination of eleventh and twelfth grade students. With the placement of 23 unspecified courses this figure is probably very near 100. Thirty-six of the courses are assigned to the eleventh grade and 38 to the twelfth, giving a total of 165 of the 237 courses a placement in these two upper grades.

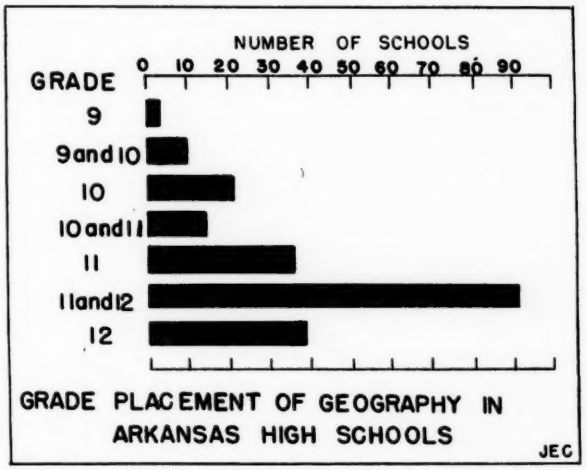

Fig. 4. Distribution of courses in high school geography, by grades.

Most of the classes which are made up of students from two or more grades are found in the smaller high schools of less than 100 students. Here, the small size and limited facilities make a combination of grade-subjects advisable. Only 19 courses are of-

fered in a combination of grades in schools of more than 150 students. Altho the fact is not substantiated by the information at hand, it seems probable that in many schools which teach geography to a combination of two grades, the subject is taught during alternate years, with another subject being taught during the intervening year. This would permit a maximum of variety of subjects with a small teaching staff and a limited enrollment.

There seems to be a tendency for the larger schools to teach geography earlier in the curriculum than do the smaller schools. Also, the larger number of students permits restriction to a single grade level, and few grade combinations are made. This contrasts sharply with the situation of small schools which often must include electives from two or more grades in order to make up a class large enough to warrant a place in the list of offerings.

QUALIFICATIONS OF TEACHERS

The training of the teachers of geography in Arkansas ranges from a minimum of 39 semester hours of college work to a maximum of the master's degree, and from none to 42 semester hours in geography. Experience varies from none to 37 years. The average teacher of geography has slightly less than the A.B. degree, seven and one-half years of experience as a teacher, and five semester hours in geography.

Information concerning the qualifications of teachers was obtained for 178 of the 237 schools. This is three-fourths of the total number and the distribution may be considered as representative. One hundred twenty-eight of the 178 teachers have degrees. This is 72 per cent of the known total. Eleven of this number also have master's degrees and six others have had some graduate work. The degrees are from 45 colleges and universities, 14 of them in Arkansas.

By size of schools, the percentage of teachers who have degrees is lowest in the smaller schools. This is not unexpected, in view of the limited facilities and the handicaps of the small school district. Improvement of qualifications with the increase in size of schools is indicated in part by the available data. From 59 per cent in the smallest size-group the proportion increases to 71 per cent in schools from 50 to 100, and to 83 per cent in schools with an enrollment between 100 and 150. Above this size there is a gradual decrease to 67 per cent in the schools of more than 400 students. The information for the larger schools is insufficient in quantity to give a dependable analysis of the situation.

Number of Hours in Geography. More than one-half of the teachers of geography have had no college training in geography (Figure 5). Approximately 14 per cent have had as much as twelve semester hours—the bare minimum for a minor in the subject. Actually, not more than thirty of the 162 teachers concerning whom data were obtained are adequately trained to teach geography. One wonders at the effectiveness of the teaching of the remaining 132 teachers.

The greater number of poorly trained teachers are found in the smaller schools of less than 150 students. Such schools are poorly equipped, have low incomes and teachers' salaries are low. The better prepared teachers tend to secure positions in better equipped and larger schools with higher salaries.

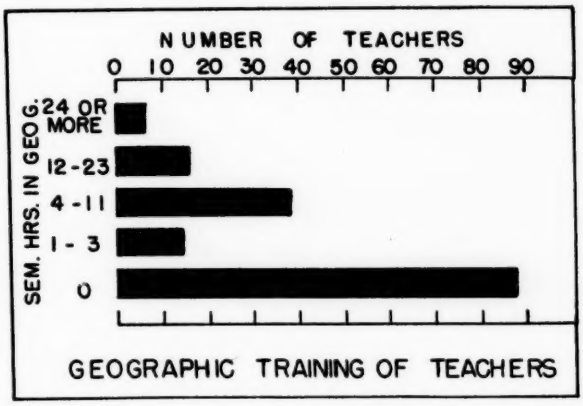

Fig. 5. Number of semester hours of college training of geography teachers.

In proportion to the total number of teachers of geography in the schools of different size groups, the greater number of poorly trained teachers are not in the smallest schools. Forty-seven per cent of the teachers in schools with fewer than 50 students belong in this category, 49 per cent of those in schools of from 50 to 99 students, and 74 per cent of those in schools of from 100 to 140 students. The proportion in the 200 to 299 size group runs to 80 per cent, but the total number is too small to be dependable.

In a consideration of the geographic training of the teachers the question of opportunities must be raised. Most of the teachers of geography, as well as teachers of other subjects, are trained in Arkansas colleges. Insofar as the writer has been able to determine, only one college (possibly two) offers opportunity for more than a minor in geography. Several offer only a single course, which is designed to meet the minimum requirement for certification. From the existing opportunities, many teachers could not obtain adequate preparation in the field at the college of their attendance.

Experience. The largest experience group for geography teachers in Arkansas is from one to five years (Figure 6). Fifteen per cent of the total number had no experience prior to the year studied. Twelve per cent, on the other hand, had been teaching for 20 years or more. The distribution of the years of experience is quite even for the different size groups, and is probably about the same as would be found for the teachers in any other field. It should be pointed out, however, that the teacher may not have been teaching geography during all of the years credited, and probably very few, if any, have taught geography exclusively.

SUMMARY AND COMPARISON WITH OTHER STATES

Less than one-half (43.6 per cent) of the 543 high schools in Arkansas teach geography. This is considerably lower than in Missouri, with 66 per cent of the high schools teaching geography,[4] in southern Illinois, where more than 80 per cent of the schools were found to teach geography,[5] and of the north central states in general. In Indiana, 109 responses to 165 questionnaires sent out indicated that all 109 of these schools teach geography.[6] In the north central states approximately three-fourths of the high schools teach geography.[7] The situation in Arkansas is much better, however, than that which

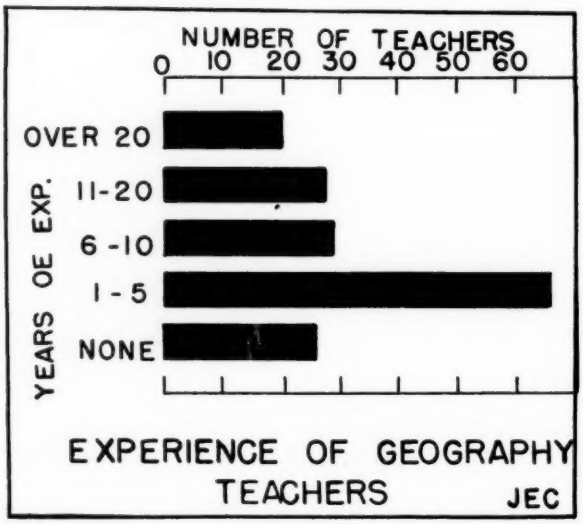

Fig. 6. Years of experience of geography teachers.

[4] Odell, Clarence Burt, and White, Leslie Wood, "The Status of Geography in the High Schools of Missouri," THE JOURNAL OF GEOGRAPHY, Vol. 41, February, 1942, p. 41.

[5] Barton, Erselia M., and Thomas F., "High School Geography in Southern Illinois," *Transactions of the Illinois Academy of Science*, Vol. 33, December 1940, p. 131.

[6] Personal communication from Dr. Floy Hurlburt, Ball State Teachers College. Muncie, Indiana, who conducted the survey in 1935.

[7] Meyer, Alfred H., Valparaiso (Indiana) University, Personal communication based

exists in Texas,[8] with approximately one-fourth of the high schools teaching geography, and in some of the western states with less than 10 per cent of the high schools teaching geography.[9]

A little more than one-half of the courses in Arkansas are a full year in length, while 114 out of a total of 116 surveyed in Missouri are of this length.[10] In southern Illinois 26 of the 47 schools have one-semester courses, 17 of them two-semester courses, 2 schools give 3 semesters in geography and 2 offer two full years of work.[11] Forty-four of the 109 high schools studied in Indiana have one-semester courses, 59 of them two-semester courses, and 6 have three-semester courses.[12] The larger number of courses is found in the smaller schools in Arkansas, and this has also been found to be the case in Illinois.[13]

Less than one-half (42.4 per cent) of the high school students of Arkansas are in schools which teach geography. The number of students enrolled in geography classes is only 8 per cent of the total high school enrollment of the State, but this is 18 per cent of the enrollment of the schools which teach geography. Only 6 per cent of the high school students in Missouri have work available in geography.[14]

Nine-tenths of the courses in Arkansas are economic, commercial or industrial. Only one-fourth of the courses in Missouri are of this nature,[15] but approximately three-fourths are in Illinois[16] and in Texas.[17] Physical geography is the description given 7 per cent of the courses in Arkansas, 6 per cent of those in Missouri, about half of those in southern Illinois, and one-third of those in Texas.

Most of the courses in Arkansas are taught during the last two years of high school training. In Missouri they were found pre-

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on information collected as Chairman of the National Council of Geography Teachers' Committee on Standards of Certification for the Teaching of Geography in High Schools.

[8] Foscue, Edwin J., "The Place of Geography in the Senior High School, With Special Reference to Texas," JOURNAL OF GEOGRAPHY, Vol. 35, March, 1936, p. 120.

[9] Meyer, Alfred H., *Op. cit.*

[10] Odell, Clarence Burt, and White, Leslie Wood, *Op. cit.*, p. 44.

[11] Barton, Erselia M., and Thomas F., *Op. cit.*, p. 131.

[12] Hurlburt, Floy. Personal communication.

[13] Cutshall, Alden, "High School Geography in Illinois," *School Science and Mathematics*, June, 1942, p. 562.

[14] Odell, Clarence Burt, and White, Leslie Wood, *Op. cit.*, p. 41.

[15] *Ibid.*, p. 42.

[16] Barton, Erselia M., and Thomas F., *Op. cit.*, p. 131.

[17] Foscue, Edwin J., *Op. cit.*, p. 120.

dominantly in the upper three grades, with only a few courses in the beginning year in each case.

The average teacher of geography in Arkansas has a little less than the A.B. degree, seven and one-half years of experience, and 5 semester hours of college training in geography. More than half the teachers have no college training in geography. In Missouri the average experience is approximately the same, but the average number of college hours in geography per teacher is 14, and only three teachers have had no training at all in geography. In Texas, 53 of 200 teachers had no work in geography.

It is the hope of the writer that this study of the status of high school geography in Arkansas will serve in some manner to stimulate interest in the field and lead to further study of the status of geography in other states. It is regretted that more complete comparisons are not possible. It is further hoped that by some means the school administrators and others in positions of authority and influence will be made to realize the value of geographic training to the high school student and to the world at large. There is ample room for both quantitative and qualitative improvement.

MAKING GEOGRAPHIC SYMBOLS FOR RIVERS SIGNIFY REALITY

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It may be debated as to whether the axiom, "Two heads are better than one," is always true, but I challenge anyone to dispute the added excellence of an idea which has run the gamut of a subject matter teacher, critic, student teacher and twenty-four fifth-grade pupils. Without discredit to my college colleague (before you guess it, I confess to being a bit disgruntled because the original idea was his), I might say that I doubt whether he would recognize the robust final product as the promising and already well developed teaching device which I adopted from him one April day. Nurture by the eager minds and active fingers of my fifth graders did the trick.

The idea, as stated to me by Professor George Corfield, Geography Department, State Teachers College, Duluth, Minnesota, was to make the symbols for rivers more real by pictorial representation showing man's use of rivers and their valleys. This was to be done by the use of a large scale sketch of the course of a river with pictures to show man's activities mounted on either side.

Near vacation days with their ensuing restless bodies and roving minds increased the challenge to provide learning situations which use rather than frustrate natural tendencies, and I seized upon the idea as avidly as a dietician welcomes the discovery of a new vitamin. However, in discussing the plan with my student teacher, Mr. Sherman Abrahamson, we decided that more learning would take place if the pupils drew the scenes. Mr. Abrahamson worked out a miniature sample after which he affirmed most emphatically that more learning did and would take place.

We set the stage, introduced the problem and secured pupils' enthusiastic response. In group planning the following decisions were made:

1. To work in groups of three, each group depicting a river of its choice. (Some guidance was given to prevent duplications and insure that major rivers were studied.)

2. To so divide the work that one person would be responsible for sketching the course of the river and the others for drawing the scenes showing life along the river.

3. To make the final charts on uniform sized sheets of wrapping paper (36″ x 18″) with pictures done on drawing paper (6″ x 9″).

4. To use black crayon for sketching the course of the rivers and labeling and appropriate colored crayons for the scenes.

5. To require that all work meet standards set by the group before acceptance for the final product.

Pupils readily recognized the fact that before any actual work could be done all must have an intimate knowledge of their rivers. Under Mr. Abrahamson's guidance they set up the following outline to guide study:

I. Location and list of states bounded or traversed by the river

II. Physical conditions of the region bordering the river from its source to its mouth: A. Rainfall. B. Growing season. C. Elevation and topography.

III. Natural resources

IV. Man's use of the natural resources and conditions

V. Large cities

The following outline of subject matter background for the Columbia River is an example of the type of preparation which preceded objective portrayals:

THE COLUMBIA RIVER

I. Location: Northwestern United States; arises in Canada, flows thru eastern Washington to its southern border from which point it forms the boundary line between Oregon and Washington to the Pacific Ocean into which it empties.

II. Physical conditions of the region bordering it from its source to its mouth.

UPPER COURSE (From source to Oregon boundary line)	LOWER COURSE (That part which forms the boundary line between Oregon and Washington)
A. Rainfall	
Northeast Washington 20-30 inches	Inland section—10-20 inches, except for central which has less than 10 inches
Central Washington 10-20 inches	
Southern Washington less than 10 inches	Coastal section—60 or more inches
Too little for many crops without irrigation	Adequate for mixed farming except in eastern section
B. Growing season	
Northeast Washington—Less than 90 days	Entire section—120-150 days
Central Washington—90-120 days	
Southern Washington—120-150 days	
Dry, sunny, hot summer days	Mild winters and cool summers in coastal area due to influence of Japan current and westerly winds
Cold, snowy winters	
C. Elevation and topography	
Except for a narrow strip of lowland along the river—1000-2000 feet elevation	Along the river valley—sea level
"Rolling plains and rounded hills"—"the Columbia Plateau"—Ref. 1. p. 109	Back from the river—500-2000 feet
	Lowland along the coast

III. Natural resources
- Rich soil formed from lava deposits
- Valuable forests
- Mineral deposits: gold, silver, lead, zinc, copper
- Salmon
- Natural grazing lands
- Beautiful scenery

- Fertile valleys
- Valuable forests
- Salmon
- Natural grazing lands
- Natural harbor—access to the Pacific Ocean from Portland by ocean going steamers

IV. Man's use of natural conditions and resources
- Wheat farming
- Fruit growing (apples, prunes, pears etc.) on irrigated lands
- Lumbering
- Mining
- Fishing

- Mixed farming—clover, oats, potatoes, wheat, alfalfa
- Dairying
- Truck farming
- Fruit farming—prunes, cherries, apples, pears, plums, loganberries, black berries —other bush fruit
- Canning fruit and fruit juices
- Lumbering
- Fishing

V. Important cities
- Portland
  - Shipping
  - Manufacturing
  - Saw mills
  - Canning, etc.

Pupils were expected to be able to account for conditions listed in their outlines.

After several days of study, in order to give proof of their readiness to go ahead, pupils reported to the class on their outlines and received criticisms and suggestions. Committees then met together and decided which scenes were of most importance and who should be responsible for each piece of work. Work now took on more of an element of play as pupils sketched and colored to convey their information. The first proud group to finish, arranged and mounted their scenes along a carefully sketched and labeled river. Results were satisfying and stimulated the other groups to finish with high standards. There remained yet to be done the jobs of putting in state boundary lines and the color symbol for elevation. The latter required careful study of the physical maps and made pupils very aware of the differences in man's use of lowlands and highlands.

My student teacher had been having fun with the "project" when I proposed the assignment of a culminating activity. After searching the library for references on the topic and reading widely he ended up with the plan to have the class take imaginary boat trips down the rivers with committee members acting as captains and guides. The pupils liked this idea and their presentations, given

after a brief period of preparation, were quite creditable.

The scheme has manifold values, I believe, especially with changes and improvements which might be made. Paramount in my own mind are the facts that pupils should do more of the planning and that more time than the rush of closing school permitted us to give, should be spent on the culminating activity.

REFERENCES

A partial list of references used in the preceding outline:

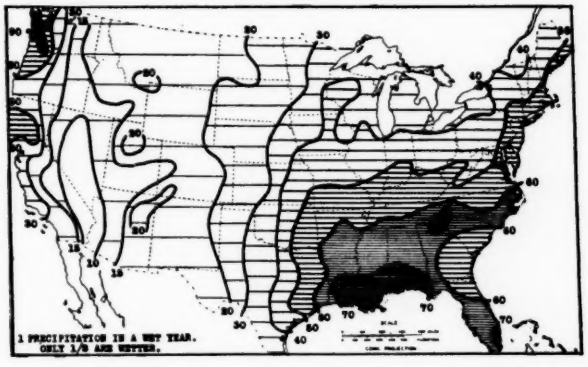
1. Bodley and Thurston. *North America*. Text p. 107-109; Maps p. 104; Pictures p. 102, wheat, apples, lumber, fish.
2. Brigham and McFarlane. *Our Home State and Continent*. Minnesota Supplement, Schwendeman. Text p. 237-239; Pictures p. 102, wheat.
3. Atwood. *The World at Work*. Text p. 181; Maps, agr. regions p. 185; Pictures p. 180, irrigated apple orchard.
4. Atwood-Thomas. *The Americas*. Text pp. 174-175, 183-187; Produce map. p. 164; Pictures, apple orchards p. 174, Portland p. 186, picking raspberries p. 184, lumbering 182.
5. Barrows and Parker. *United States*. Text pp. 48-52, 63; Maps, precipitation p. 36, irrigated lands p. 57, growing season p. 85, produce 88-90; Pictures, wheat pp. 49-51, orchards p. 50, Portland p. 60.

WET AND DRY YEARS IN THE UNITED STATES

STEPHEN S. VISHER
Indiana University

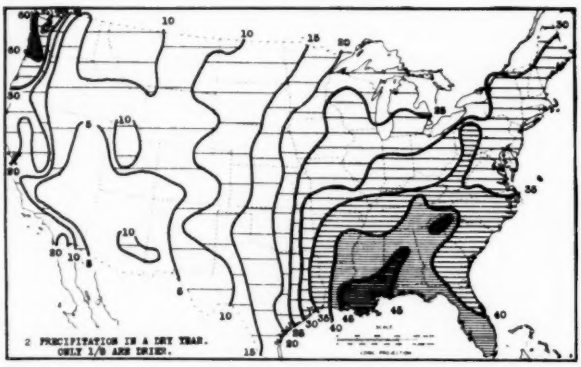
Crops grow, of course, with the precipitation which actually falls at a time to be useful, not with the "average" fall. Indeed, statements of the average have little meaning in the large share of the world where the rainfall is uncertain. In the eastern part of the United States, the common departure from normal is not great, about 50 per cent for the annual total and about 100 per cent for a particular season; for example a distinctly wet summer receives about twice as much as a dry one. In the Midwest, the variation is about twice as great as in the East, while in much of the West it is at least three times as great. In exceptionally dry years almost no rain may fall in some desert areas, while in a wet one, several inches or more may fall.

The 1941 Yearbook of the U. S. Department of Agriculture presents a map of the precipitation for the average of the ten wettest years of the forty years 1899-1938. Thus it shows the amount received in a year that is so wet that only one-eighth of the years are wetter. The first of the accompanying maps is a shaded, somewhat smoothed and simplified copy of that map.

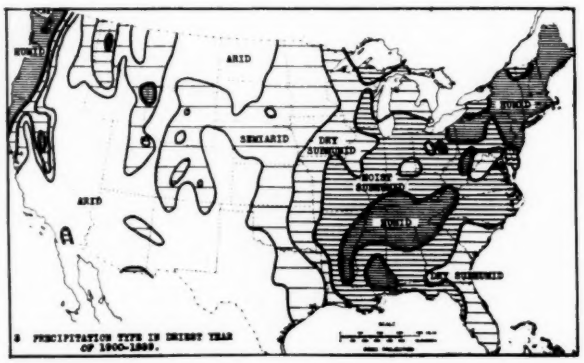


It shows that in such a wet year, more than half of the East receives 50 inches or more and a considerable Gulf Coastal area receives more than 70 inches. A small part of that area, and a part of the southern Appalachians receives 80 inches. Indeed, two weather bureau stations in western North Carolina then receive an average of 100 inches. About three-fourths of the West receives, in the wettest one-eighth of the years, more than 15 inches of precipitation; only about a tenth receives less than 10 inches. A small part of the Northwest receives more than 90 inches, two stations receiving more than 120 inches.

The second map of this little article shows the amount of precipitation received in a dry year—only one-eighth of the years are drier. (This map is also a shaded, somewhat simplified copy of one in the 1941 Yearbook.) In such a dry year, only about a third of the East and a small northwestern area receives as much as 40 inches. Considerably more than half of the country receives less than 15 inches, and about an eighth receives less than 5 inches. In such a dry year, Washington, D.C., for example, receives about 33 inches, in contrast to about 50 inches in a wet year. It receives in a dry year no more precipitation than central Kansas receives in a wet year. Central Kansas receives in a rather dry year, however, only about half as much as in a wet one.

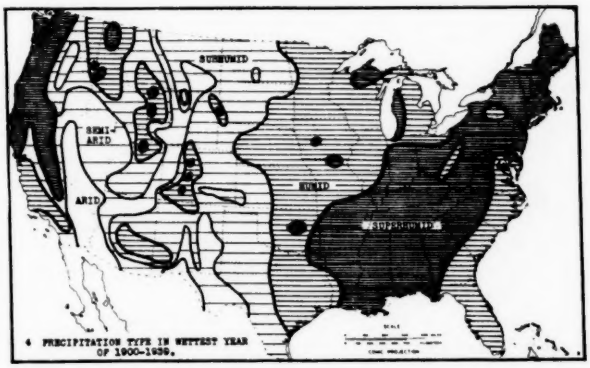


It would be interesting to have maps for precipitation corresponding with those of the first articles of this series, which showed the highest and lowest temperatures recorded in 40 years. As such maps of the greatest and least precipitation are not available, the other two maps of this article were prepared by combining parts of many maps of Thornthwaite's "Atlas of Climatic Types 1900-1939," recently published by the U. S. Department of Agriculture (Miscel. Publication No. 421. 96 plates, 1941, $1.25).



The third map shows the total or maximum area which was arid, semiarid, or dry subhumid at least once during 1900-1939. Thus conversely, it shows the smallest extent of humid, superhumid or moist subhumid conditions in any year. Arid, semiarid,

subhumid, humid and superhumid as here used are technical terms involving temperatures as well as precipitation. Their limits are determined by the "precipitation-effectiveness-index," which is laboriously calculated. Roughly, arid includes all areas receiving less than about 12 inches of annual precipitation in the warmer parts of the country but only those receiving less than about 7 inches in the cooler part. In cool regions, areas receiving more than about 7 inches are classed as semiarid by this classification. Subhumid means about 20 to 30 inches, on the average; humid means 30 to about 55 inches for the average, but in the warmer part of the country an area is not classed as superhumid unless it receives more than about 65 inches. In the cooler regions, however, 50 inches results in superhumidity.



4 PRECIPITATION TYPE IN WETTEST YEAR OF 1900-1939.

This third map shows that in the driest year of 1900-1939 (often different years in different places) nearly half of the country was arid. Aridity extended east to the tall grass or prairie section of the Dakotas and Texas. The semiarid zone extended as far east as the western edge of Wisconsin and Louisiana. Much of Michigan, Iowa and Florida were dry subhumid rather than the usual humid. Most of the rest of the East was moist subhumid in the driest year, while the truly humid sections included only most of the Northeast, a part of the South, and the North Pacific Coast. 1934 was the driest year for most of the country. In that year the arid region was fully ten times as large as in 1904.

The fourth map shows that maximum extent during the 40 years studied of humid, superhumid, and moist subhumid. Conversely, it shows the extent of the areas which were arid or semiarid in every year of the forty. This final map shows that in the wettest year of the forty, more than half of the East and a large northwestern area were so wet as to be classed as superhumid instead of humid, while the rest of the East was humid. In such a very wet year about half of the West is subhumid rather than semiarid or arid, as it normally is. In this wettest year (often different years for different

places) little of the West is arid, less than a tenth as much as in the dry year shown by the third map.

The maps of the Atlas of Climatic Types 1900-1939 afford considerable interest. Perhaps of special interest are those of the frequency of the occurrence of the various climatic types, especially during the crop growing season (defined as March thru August). For example one map shows that semiarid or arid crop seasons occur in less than one per cent of the years, if ever, in most of the East, but occur in about one-fourth of the years about midway between the Atlantic and the Pacific. In much of the West, more than three-fourths of the crop seasons are semiarid or arid. Another map shows that a dry subhumid crop season occurs rarely in only about one-eighth of the East. In the middle of the country from east to west, dry subhumid or semiarid crop seasons occur in about half of the years. Almost all of the crop seasons in the West are dry subhumid, semiarid, or arid.

The maps here given, and the others available, show clearly that in the United States there are wide differences in the amount of precipitation, just as there are in the amount of heat (discussed in the previous article of this series). The reasons for the wide differences between wet and dry years are not adequately known. Important influences are variations in the frequency, intensity, rate of movement, and size of cyclonic disturbances. These disturbances set up movements of air called winds but recently called "air masses" by some who wish to use technical language. Cyclonic disturbances (Highs, Lows and tropical cyclones) vary partly as a result of changes in pressure and temperature in distant places. Solar changes affect the atmosphere in complicated ways, helping to produce some of these changes.

Altho it is not yet possible to give the causes for the regional variations shown on these maps, an essential first step towards the solution of such problems is to have the facts to be explained clearly in hand. These maps are a step in that direction. In addition, they help afford a basis for reasonable expectations as to precipitation, which should lead to wiser adjustment to the environment. This article also calls attention to two valuable recent publications where more information may be found (altho no discussion comparable to that here given).

ILLUSTRATIVE MATERIALS FOR CONSERVATION EDUCATION. VI. MOTION PICTURES

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The motion picture possesses the obvious advantage of showing things moving. The sound motion picture has the additional advantage of presenting an illusion of reality by its environmental sounds and its explanations simultaneous with the action. True, some conservational concepts lend themselves especially well to silent treatment; for example, in a consideration of the habits and habitat of our wildlife a human voice often seems out of place and robs the scene of its illusion of reality. On the other hand the sound of a bird call heard in relation with a closeup of the bird uttering the sound is a thrill which fosters appreciation of our feathered friends. Whether silent or sound the motion picture serves a unique function in conservation education.

The conservation film furnishes an ideal introductory device for a unit on conservation. The writer teaching such a unit at Lincoln School, Teachers College, Columbia University used the Erpi Classroom film "Conservation of Natural Resources" to arouse interest in this topic. This film furnished an overview of the subject and, like a good educational film should, raised problems for the consideration of the pupils. The same film was shown again during the middle of the unit to clear up questions of fact which had arisen during the course of the study. Again at the end of the unit the film was shown for the purpose of review. Incidentally, this third and last showing was one of the most successful and enjoyable of all, for the youngsters now had the "feel" of the subject and were looking for confirmation of generalizations arrived at during their consideration of the topic. Here, then, we see three uses of the film in education; as an introductory device, as a source of reference to which the pupils may turn as they would to a reference book, and as a means of summary or review. The same film need not be used for all three purposes, often a film with a different point of view may be presented to arouse controversy and discussion.

A good film should stimulate further activity on the part of the audience. To assure a receptive frame of mind on the part of the pupils the teacher should know the content of the film thoroly so that he may be able to ask the proper type of motivating questions

and create a desire on the part of the pupil to view the film as a learning opportunity. Such familiarity may best be gained by previewing the film before presenting it to the class. This preview provides the teacher with an opportunity to plan the proper use of the film. Some teachers find it advantageous to invite a student committee to this film preview and to have members of the committee present the film to the class and indicate items especially worth looking for. Because a proper mental set should be established and because follow-up activities and discussion should take place immediately after the film showing, the ideal length for a classroom film is one or two reels. A one reel (400 foot) silent film (16 frames per second) requires 15 minutes of actual running time, while a one reel sound film (24 frames per second) is run off in ten minutes. If a two reel sound film is shown in a 40 minute class period about ten minutes may be allotted for introduction and ten minutes may be reserved for discussion after the showing. It is not necessary to show an entire film if a portion of it will do the job. If the first part of the film presents a particularly good picture of a process, or presents a problem worth considering, it may be shown to the class and when extraneous material enters, the machine may be shut off. Likewise the last part or middle of a film may be shown by running off the film to the point desired, before the class begins, and then showing the portion of the film which is of particular value. After a bit of experimentation the teacher may decide to utilize such methods as shutting off the sound and explaining the film, or carrying out a discussion as the scenes roll by.

A large number of films are available for showing such aspects of the conservation problem as the need for wise resource use, the steps now being taken, the extent and nature of our resources, and the value of a well-rounded conservation program. In all its aspects the films on this topic are far too numerous to be included in this article. For this reason the list which follows is limited to 16mm films which show the need for conservation and present the practices now being employed. For films on our mineral, timber, soil and other resources the interested teacher should consult one of the following general catalogues:

American Council on Education, *Selected Educational Motion Pictures.* Washington, D.C., 1942.

Bathhurst, Effie, *Conservation Films In Elementary Schools.* Washington, D.C.: U. S. Office of Education, 1941.

Cook, D. C. and Rahbek-Smith, Eva, *Educational Film Catalogue.* New York: H. W. Wilson Co., 1939 and semi-annual supplements and quarterly supplements.

Educational Screen, *1001—Blue Book of Non-Theatrical Films*. Chicago, 1942.
Hartley, W. H., *Selected Films for American History and Problems*. New York: Teachers College, Columbia University, 1940.

It should be noted that the films from the Department of Interior have been withdrawn for the duration of the war and that the films from the Department of Agriculture are available only to county agents and field workers of the department. It is possible, however, to rent some Interior films from film libraries. The Department of Agriculture films relating to conservation may be readily obtained from the nearest area headquarters of the Soil Conservation Service. Many prints of the Agriculture films have been placed in state film libraries and may be obtained thru these agencies. A slight service charge is usually made for the use of these films. For films issued by regular classroom film producers the rental fee averages $1.00 per reel for silent subjects and $1.50 for sound subjects. This rental fee is usually for one day's use.

General or Overview Films

Conservation of Natural Resources. 1 reel. Sound. Erpi Classroom Films Inc., 1841 Broadway, New York. (How our great Natural Resources have been wasted and the steps being taken to conserve them)

Price of Progress. 2 reels. Sound U. S. Dept. of Interior. (Efforts of the Dept. of Interior to cope with the problem of waste)

The Living Land. 1 reel. Sound. U. S. Dept. of Agriculture. (Importance of the good land to the nation)

Conservation of Forests

California Giants. 4 reels. Sound. YMCA Motion Picture Bureau, 347 Madison Ave., New York. (Redwood lumber from forest to consumer)

The Conquest of the Forest. 1 reel. Silent. General Electric Co., Schenectady, New York. (A survey of lumbering in the northwestern United States and the application of electricity to this industry)

Fire Weather. 2 reels. Sound. U. S. Dept. of Agriculture. (How the U. S. Weather Bureau aids in preventing forest fires)

The Forests and Health. 1 reel. Silent. U. S. Dept. of Agriculture. (How forests furnish recreational facilities)

How Forests Serve. 1 reel. Silent. U. S. Dept. of Agriculture. (A summary of the importance of forests)

It Might Have Been You. 1 reel. U. S. Dept. of Agriculture. (Story of the great forest fire in Priest River County, Idaho)

Lumbering in the Pacific Northwest. 1 reel. Silent. Eastman Teaching Films. (Title self explanatory)

Reforestation. 1 reel. Silent. Eastman. (Introduction to forest conservation)

Stop Forest Fires. 1 reel. Sound. U. S. Dept of Agriculture. (Causes and consequences of forest fires)

Trees and Men. 4 reels. Sound. YMCA Motion Picture Bureau, 347 Madison Ave., New York. (Treatment of timber as a crop)

Trees To Tame the Wind. 2 reels. Sound. U. S. Dept. of Agriculture. (The use of the shelter belt)

Timber. 1 reel. Silent. U. S. Dept. of Agriculture. (How western pines are harvested)

The Tree of Life. 2 reels. U. S. Dept. of Agriculture. (The "sustained yield" plan explained)

Unburned Woodland. 1 reel. Silent. U. S. Dept. of Agriculture. (Advantages of keeping forests alive and green)

Conservation of Natural Beauty

Magic Yellowstone. 1 reel. Silent. YMCA Motion Picture Bureau, 347 Madison Ave., New York. (A trip to Yellowstone National Park)

National Park—Yosemite. 1 reel. Silent. Eastman Teaching Films, Rochester, New York. (General tour of Yosemite)

Rocky Mountain Grandeur. 1 reel. Sound. Technicolor. Teaching Films Custodians, 25 W. 43 St., New York. (The Rocky Mountains and their foothills)

Scenic Resources of the Tennessee Valley. 1 reel. Silent. Tennessee Valley Authority, Knoxville, Tenn. (Parks and power projects)

A Visit to Mesa Verde. 2 reels. Silent. U. S. Dept. of Interior. (Tour thru Mesa Verde Park)

The Wonder Trail. 1 reel. Sound. Bell and Howell, 1801 Larchmont Ave., Chicago, Ill. (Yellowstone National Park)

Yellowstone National Park. 1 reel. Silent. Eastman. (Title explains)

Yellowstone Park. 1 reel. Sound. Technicolor. Teaching Films Custodians, 25 W. 43 St., New York. (Beautiful color shots of Yellowstone)

Zion—Canyon of Color. 1 reel. Sound. Technicolor. Teaching Films Custodians, 25 W. 43 St., New York. (Zion Canyon National Park)

Soil Conservation

Home On The Range. 1 reel. Sound. U. S. Dept. of Agriculture. (Control of erosion in the public domain)

Irrigation. 1 reel. Silent. Eastman Teaching Films, Rochester, N.Y. (Artificial watering of crops in the west)

Irrigation Farming. 1 reel. Sound. Erpi Classroom Films, 1841 Broadway, N.Y. (Problems of irrigation farming)

Muddy Waters. 1 reel. Sound. U. S. Dept. of Agriculture. (Land use and abuse in the southwest)

The Plow That Broke The Plains. 2½ reels. Sound. U. S. Dept. of Agriculture. May be rented thru Bell and Howell. (The exploitation of the Great Plains and the destruction of the soil)

Rain on the Plains. 1 reel. Sound. U. S. Dept. of Agriculture. (The Great Plains' need for soil conservation measures)

Terracing to Save Our Farms. 1 reel. Sound. International Harvester Co., 180 N. Michigan Ave., Chicago, Ill. (Techniques of terracing)

Wise Land Use Pays. 2 reels. Sound. U. S. Dept. of Agriculture. (Principles of soil conservation)

Conserving Our Water Resources

The Building of Boulder Dam. 1 reel. Sound. International Harvester Co., 180 N. Michigan Ave., Chicago. (Boulder Dam project from start to finish)

Challenge of TVA. 3 reels. Silent. Harmon Foundation. (Social implications of the TVA)

Lest We Forget. 1 reel. Silent. U. S. Dept. of Agriculture. (Pickens Canyon fire and Montrose, Calif. flood)

The River. 3 reels. Sound. U. S. Dept. of Agriculture. (The story of the Mississippi River, its importance, and its mismanagement)

The Story of Water Power. 2 reels. Silent. U. S. Bureau of Mines, 4800 Forbes St., Pittsburgh, Pa. (Water power and its use)

TVA. 2 reels. Sound. Tennessee Valley Authority, Knoxville, Tenn. (7 years of work and accomplishment at TVA)

TVA at Work. 1 reel. Silent. Tennessee Valley Authority, Knoxville, Tenn. (How TVA prevents floods)

Water Power. 1 reel. Sound. Erpi Classroom Films, 1841 Broadway, New York. (Development of water power in the United States)

Conservation of Wildlife

Birds and Animals of Yellowstone Park. 1 reel. Silent. YMCA Motion Picture Bureau, 347 Madison Ave., N.Y. (Survey of large variety of animals in Yellowstone)

Forest Fires or Game. 1 reel. Sound. U. S. Dept. of Agriculture. (How forest fires affect wildlife)

Game Management. 2 reels. Silent. U. S. Dept. of Agriculture. (Experiments in control of wildlife)

Heritage We Guard. 3 reels. Sound. U. S. Dept. of Agriculture. (Interrelation of wildlife and soil conservation)

Quest of Alaska Sealskin. 2 reels. Silent. U. S. Dept. of Commerce. (How the seal herd on the Pribiloff Islands is managed)

Return of the Buffalo. 1 reel. Sound. Teaching Films Custodians, 25 W. 43 St., N.Y. (Buffalo herds under man's protection)

Vanishing Herds. 2 reels. Sound. U. S. Dept. of Agriculture. (How bison, elk, and other game have been depleted)

EDITORIAL NOTES AND NEWS

Never before in the history of America has there been such a demand for geographical knowledge. Leading educators thruout the country are demanding that more and better geographical training be given our young men and women who must soon assume responsibilities of adult citizenship. Geographic education has been long neglected in American schools. Fortunately, we have some leaders who aim to do something more than talk about the need for geographic education and the need for adequately trained teachers. The National Council for the Social Studies has definitely recommended a full year of geography in the high school. It is also a genuine pleasure to learn that Clark University has secured the services of Kathryn Schnorrenberg, a specialist in workshop procedure, for its summer session, and has set up a special program for geography teachers. The entire geography staff of the University will co-operate in the work. The JOURNAL extends hearty congratulations to Clark University! We wonder how many others are actually *doing something,* more than ordinary, to meet the present demand and to utilize an unprecedented opportunity. If the geography departments of our institutions of higher learning do not act effectively, rest assured that other departments will attempt to direct the geography teaching.

DR. GEORGE H. PRIMMER, State Teachers College, Duluth, Minnesota, is now serving as Associate Geographer in the Chief of Staff division of the army in Washington.

DR. VAN RIPER and ANNE M. KRAUSE, members of the geography department of the Southern Illinois Normal University, Carbondale, along with Miss Mabel Eads, are now filling geography positions in Washington, D.C.

According to information from the U. S. Department of the Interior, an ore bed that can yield millions of tons of ore containing vanadium has been discovered in Idaho and Wyoming. Thus far our supply of vanadium, so essential in toughening steel, has come from overseas, chiefly from Peru. The Geological Survey back in 1911 reported the presence of small amounts of vanadium in our western phosphate beds. Research was directed toward the saving of the vanadium as a by-product in phosphate mining, and in 1941 methods were devised to accomplish the saving. About that time came the discovery of a bed of ore containing more vanadium than the phosphate rock itself with which the bed was associated. By the spring of 1942, after rigorous testing, mapping and a set-up of federal control, the development was turned over to a well-known gold mining company and vanadium production is expected shortly.

OTIS W. FREEMAN of Eastern Washington College of Education, Cheney, Washington, was the editor of the special Geography number of *Education,* issued in January, 1943. The publication features articles of timely interest contributed by nine geographers.

Free loan packets of materials of general interest or of particular interest at various educational levels are available from Information Exchange, U. S. Office of Education, Federal Security Agency, Washington, D.C. Eighty different packets are available, but only two packets may be ordered at a time for a period of two weeks. Each packet contains twenty items ranging from one page to more than twenty pages, each item offering suggestions as to how schools and communities can aid in the war effort.

According to the National Bureau of Standards, the new 5-cent piece contains no nickel. It consists of 56 per cent of copper, 35 per cent of silver, and 9 per cent of manganese. This results in a saving of 300 tons of nickel for essential war production.

The Committee on International Affairs of the National Education Association announces the inauguration of a six-months meteorological training program for Latin Americans at the university center of Medellin, Colombia. It will be carried out in co-operation with the United States Weather Bureau and the Defense Supplies Corporation. At the completion of the training period, fellowships for a year's study in some of the leading universities and Weather Bureau of the United States will probably be granted to superior students.

If you are planning a program for Pan American Day, April 14, you can get helpful material from the Pan American Union, Washington, D.C.

In view of the scarcity of certain essential materials due to the lack of cargo space and submarine activities along the sea lanes on which these products move, specialists are on the alert for substitutes, new technologies, and new producing areas. Milkweed floss, and bubbles and fibers made from plastics or glass are buoyant materials replacing our overseas supplies of cork and kapok in equipment for keeping people or cargoes afloat. Lack of rubber from the Far East spurs on the quest for rubber from the wild rubber trees of South America. There the problem also is to supply workers and at the same time safeguard them against tropical diseases and provide for their material and social wants. Maybe this wild rubber will yield some forty thousand tons in 1943. New rubber plantations have little to offer, tho new plantings are being set out. Almost any plant with latex is under investigation, such as the guayule, golden rod, kok-sagyz- (Russian dandelion) and Crypostegia. The latter is a vine, almost any part of which yields latex. None of these plants holds out any hope of supplying our rubber needs. If an adequate supply is forthcoming, it apparently will come from synthetic rubber made from petroleum or farm products.

GEOGRAPHICAL PUBLICATIONS

Derwent Whittlesey. **German Strategy of World Conqest.** 293 pp. Illustrated. Farrar and Rinehart, New York. 1942. **$2.50.**

To practically all Americans this book will prove an amazing revelation of how German plans of world conquest include the Western Hemisphere nations as well as the already conquered States of Europe. The book is largely documentation with literal translation of German thinking, planning, and organization for world conquest as expressed in a wealth of German publications. The authors provide organization, sequence, and interpretation. The development of German diplomacy and military strategy is traced from Frederick the Great to the modern, crafty and ruthless Haushofer. An excellent outline of the growth and utility of Geopolitics is provided. The relations of earth and the German State in this new and dynamic application of geography becomes clear. The dynamic nature and implications of Geopolitics is impressive in this quotation from the German writer Schenke in 1938: "The one who attacks a country of broad spaces has to win a victory, a victory which does not consist of driving the enemy farther and farther back until he has occupied the piece of land which he desires. This only serves to give the enemy time and opportunity to reorganize himself in the vast unoccupied parts of his country and to mobilize all his resources, if there are vast spaces for the continuation of a long war. Therefore, the war against such an imperium can only be won by the swiftest possible destruction of the enemy's armies."

A better realization of this geoprinciple than the subsequent German campaign in Russia, can not be found.

This should be a must book for all Americans interested in their own and the

world's welfare. The reader should, however, make a reservation in favor of the German people led by such fair and tolerant Germans as Neimuller and Falhauber.

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O. D. von Engeln. **Geomorphology: Systematic and Regional.** 655 pages, 372 illustrations, 7 plates of parts of topographic maps. The Macmillan Company, New York, 1942. $4.50.

In "Geomorphology: Systematic and Regional" by O. D. von Engeln, geographers and geologists have available a scholarly and unusually complete treatise on the origin and development of the surface features of the earth. The book was written as a text-book for college classes for which it is well adapted. In addition the book will become a standard reference work and should be added to libraries universally for that purpose.

In his "Geomorphology" von Engeln, for the first time in an American book, gives adequate treatment of the theories of the German geomorphic school exemplified by Penck, as well as to the ideas of the American, W. M. Davis, regarding geomorphic cycles for the development of surface features.

The book is divided into 23 chapters. There are 372 illustrations that fit in well with the text which they supplement and not merely decorate. Numerous drawings are used for descriptive purposes and to clarify word descriptions. After a consideration of the relief of the ocean floor, von Engeln classifies geomorphic structures into 18 types and then proceeds to describe the processes, stages and cycles noted as affecting the types of structures.

Much space is devoted to the peneplain concept with comparisons being given between the erosion cycles as postulated by Davis and the ideas of Penck. Cycles and geomorphic systems are described under both humid and arid conditions. The relation of folds, faults, volcanism and variations in resistance of rocks to the geomorphic processes and the stage and cycle of erosion are all adequately described. Other chapters discuss the glacial geomorphic cycle, the geomorphology of coasts, coral shore lines and atolls, and karst topography.

"Geomorphology" was not written for popular reading and students should have taken a course in physiography or general geology before using the text, since a general knowledge of simple geological processes is assumed thruout. In general the book starts in where beginning texts leave off.

The reviewer recommends von Engeln's "Geomorphology" highly. It contains a wealth of material from both American and European sources and well selected references to the literature. The book should be well received by geologists and geographers who are interested in the origin of land forms. The inclusion and definition of many foreign terms for land forms is very advantageous to the ordinary reader. The general arrangement and typography of the book are excellent. "Geomorphology" should be a useful text and reference book for many years.

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